ANTHRACNOSE (*DISCULA DESTRUCTIVA*), A NEW DISEASE AFFECTING POPULATIONS OF CORNELIAN CHERRY (*CORNUS MAS*) FROM THE BANAT MOUNTAINS

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Abstract. *In the flora of the Banat mountains there are important populations of Cornus mas known as Cornelian cherry in Europe and as dogwood un North America. Those populations are placed especially on the slopes up to an altitude below 1000 meters. Like many other species, this shrub can be used both for medicinal purposes (especially fruits but also young leaves and shoots) and as an ornamental plant (especially for live fences or even as a honey plant in some areas). Flowers, fruits and bark of Cornelian cherry (harvested from young shoots) are used as a medicinal plant. In other areas of the world Cornelian cherry seeds are used to obtain a special medicinal oil. From the shrubs bark a red pigment can be obtained. Also, the leaves can be used as a source for tannin extraction. The wood of this species is very hard and can be used even in the manufacture hinges for wooden fence gates. During the study of the medicinal plants pathogens from the spontaneous flora of the Banat mountains, we observed relatively small spots (max. 15 mm) of black color. Some of these spots have a central light color point. Those dark spots were randomly placed on the entire leaf surface, between the ribs. During the laboratory analysis, the fruiting bodies observed were acervulus. This fulfilled all the anatomical characteristics of the species Discula destructiva, a characteristic pathogen for the Cornelian cherry (Cornus mas). The present paper presents results regarding the spread of the pathogen in the investigated area and also an assessment regarding the amount of inoculum of the pathogen Discula destructiva. Cornelian cherry populations on which observations have been made are distributed on different altitude steps and also cover all the relief forms present in the investigated area, from the floodplain of some rivers such as Nera and Cerna and up to high mountain valleys such as the one in which the city of Anina is located.*

Keywords*: Cornus mas, Discula destructiva*

INTRODUCTION

Cornelian cherry (*Cornus mas*) is a shrub, widespread in the mountainous areas of western and southwestern Romania, in the area known as the Banat Mountains. It can be found up to altitudes over 1400 m. This shrub is quite well adapted to this area and seems to have no special requirements on climate and soil conditions. On the contrary, due to the fact that it develops relatively normally on lands with steep slopes, it can be said that it helps to fix the soil and helps to reduce landslides.

First reports on the fungus *Discula destructiva* threatening came in North America at the beginning of 1970s (YONGHAO LI, MARGARET T. MMBAGA, ALAN S. WINDHAM, MARK T. WINDHAM, ROBERT N. TRIGIANO, 2009) and in Europe even later (Tóth A.,, Petróczy M. ,Palkovics L., 2017).

From the biological properties point of view, Cornelian cherry is distinguished by its very resistant wood. Also, this species has a high vitality, the lifespan being even 200-300 years and a special resistance to frost, surviving even at - 40 ° C (BRINDZA P ET AL, 2007). Shrubs bloom very early in spring, providing a source of food for bees that emerge earlier in the winter. *Cornus mas* species have different susceptibility on fungus *Discula destructiva*, depanding gneraly on chemical composistion (CARDWELL A. NICOLE, MCDANIEL L.G., 1998) and the cultural practices if we refer to Cornelain cherry or dogwood from gardens. (DAUGHTREY M. L., HIBBEN C. R., BRITTON K. O., WINDHAM M. T., REDLIN S. C. 1996; DAUGHTREY M. L., HAGAN A. K., 2001; WILLARD

T. WITTE, MARK T. WINDHAM, ALAN S. WINDHAM, FRANK A. HALE, DONNA C. FARE AND WAYNE K. CLATTERBUCK, 2002;) On further ,

Researches conducted after 2010 shows that fruits of Cornelian cherry have obvious antibacterial effects (KRZYŚCIAK P., ET AL, 2011), both against Gram-negative and Gram-positive bacteria (KRISH J., ET. AL., 2008). Also, the fruits eaten fresh, as well as the decoctions made from fruits and from the young branches bark, have therapeutic effects especially for stomach disorders.

Active substances contained in dogwood berries have also a surprisingly beneficial effect on human skin and can successfully replace synthetic substances (POLINICESCU C. et al., 1980).

Dogwood anthracnose caused by the fungus *Discula destructiva* is a disease observed in the populations of Cornelian cherry (*Cornus mas*) in the southwestern part of Romania, in the area known as the mountainous Banat. Fungus fruiting body is a subcuticular acervuli formed on the leaves and twigs (WARD GAUTHIER NICOLE, STOLZ SARAH, 2017). Conidiophores formed inside acervuli are integrated and branched with elongated cylindrical acuminate phialides. Conidia are ellipsoid, nonseptate, hyaline and guttulate.

MATERIAL AND METHODS

We perform the assessment of Cornelian cherry (*Cornus mas*) diseases between 2017-2019 in the mountainous and pre-mountainous area of the Nera River and its tributaries. This is because at maximum distances of 150 meters left and right from the banks of the river Nera or their tributaries there are significant populations of Cornelian cherry (Cornus mass). The evolution of Cornelian cherry pathogens, as in most pathogens case, is strongly influenced by the evolution of climatic factors. Climatic data are those given by satellites for the reference area and taken from the website www.WorldWeatherOnline.com, these data having the property of being of the best quality. Although at first glance it seems that the evolution of climatic conditions is normal over the three years, important differences can be noticed. Thus, the highest temperatures during the period June-August were those recorded in 2019 (figure 1). In the same year, a negative average of January temperatures was recorded, which makes the temperature variability the largest of the three years of measurements.

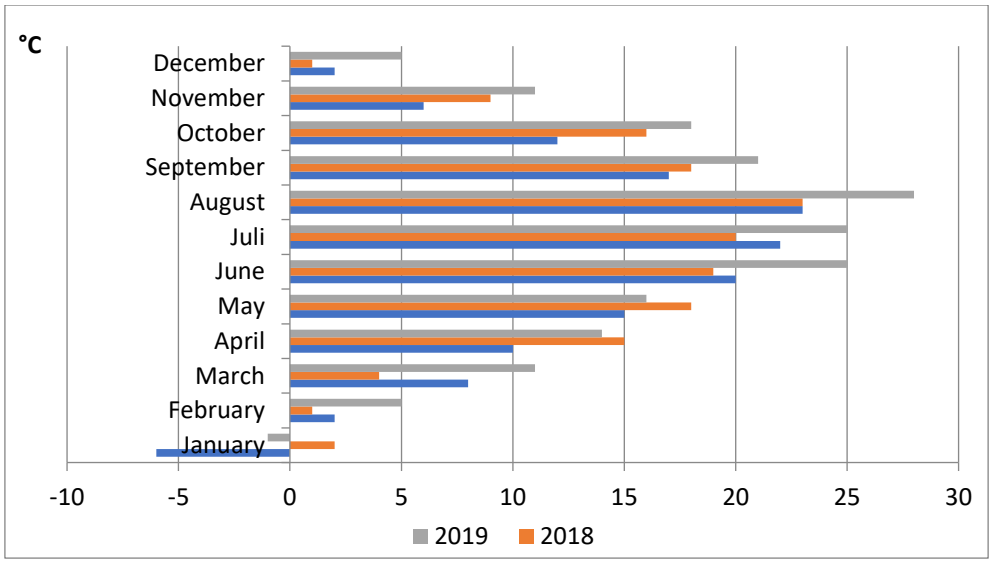

Figure 1. The evolution of temperatures monthly averages between 2017 and 2019

The evolution of precipitation as opposed to that of temperatures had a greater variability. Thus, it can be observed that given that the annual amount of precipitation in 2017 was only 242.4 mm, in 2019 the amount of precipitation was 1069.6 mm. The wettest months in 2019 were May (93.1 mm) and June (274.4 mm) plus 146.5 mm of snow and autumn rains, mostly in November (118 mm) .

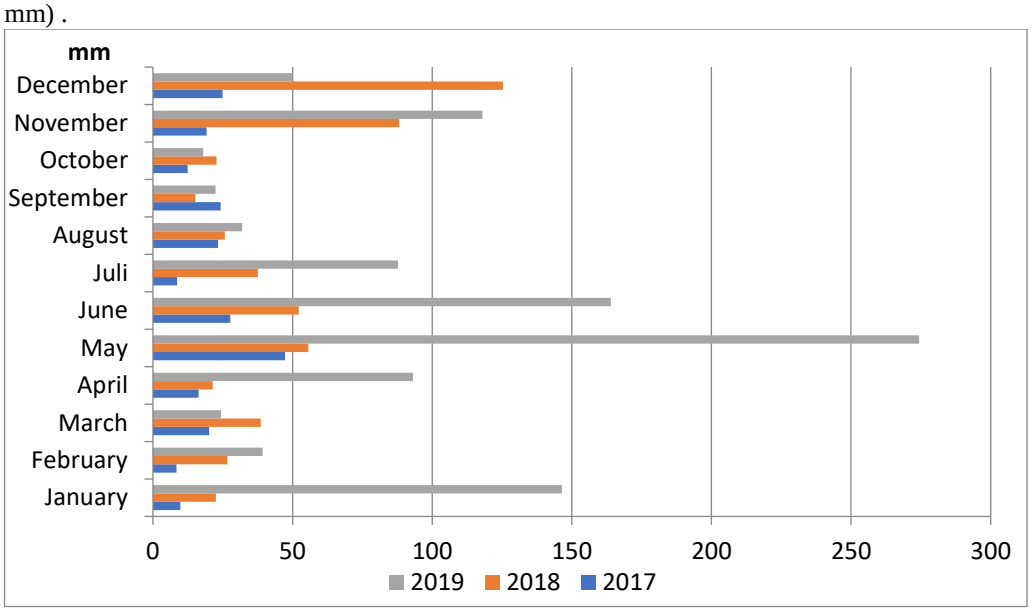

Figure 2. The evolution of monthly total rain water between 2017 and 2019

The analysis of the anthracnose attack on the horn was made based on the statistical analysis of the data on the frequency of attack (which indicates the virulence of the pathogen) and the intensity of the attack (which indicates the aggressiveness of the pathogen). Differences between years and between populations were analyzed by a statistical calculation characteristic of two-factor experiments. For an objective comparison between the populations and between the experimental years, we introduced as a witness the average of the experimental factors.

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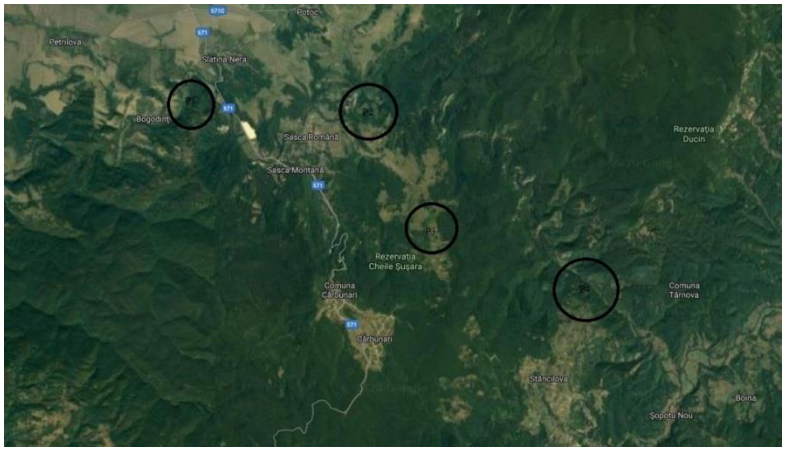

Figure 3. Populations distribution on the research area

The data were recorded respecting the phytosanitary control norms. The data of each population were collected from shrubs located on a maximum area of 500 m2, the leaves analyzed on each shrub being on 3 branches located on different directions of development from the axis of the shrub stem. The tables in this paper, which show the frequency and intensity of each repetition, are an average of the three shrubs on which these observations were made.

RESULTS AND DISCUSSIONS

In all four areas where the evaluated populations were located (figure 1) there were clear symptoms of anthracnose (*Discula destructiva*) on Cornelian cherries shrubs, with typical necrotic spots clearly defined and separated by the healthy tissues by a dark "line". Inside of this tissue are the asexual fungus fruiting bodies, the acervuli. If anyone try a careful observation, when acervuli reach full maturation, they can be seen as dark points on the grey necrotic tissue.

Figure 4. Leaves of *Cornus mas* affected by fungus *Discula destructive*

The surfaces affected by the fungus attack have different areas of necrotic tissues depending on the evolution of the fungus pathogeny evolution. It is well known and accepted that the fungus evolution depends on some major external factors. On the case of fungus *Discula destructiva* it is clear that main factors, which influenced the pathogeny evolution were the quantity and the time distribution of the rains, because the temperature limits for the fungus development are accomplished between May and September.

As it results from table 1, the attack frequency is almost the same on all four populations, differences of each evaluated population to average , which we use as control on statistic calculation, are very low. For this reason, the statistic calculation releases no significance for the fungus attack frequency between populations.

On the other hand, looking at the climate evolution during the three years of the observations period it is very clear that there are differences between these years regarding both the temperatures and the amount of rainfall (table 2). These differences are reflected on *Discula destructiva* attack frequency, which show a negative significant difference between 2017 average value and the year average value, which is experimental control. Also, there was a significant difference in case of the attack frequency from 2019 (table 2).

Table 1.

Attack frequency evolution of fungus Discula destructiva on the evaluated populations

Nr.	Factor A Populations	Factor B - Experimental year			Factor A averages	Differences	Significance
		2017	2018	2019			
1	Bogodinți	18.3	21.7	25.0	21.7	-0.1	-
2	Tunele	20.3	21.3	24.7	22.1	0.4	-
3	Șușara	18.7	22.3	25.0	22.0	0.3	-
4	Șopot	17.3	21.0	25.3	21.2	-0.5	-
5	Average	18.7	21.6	25.0	21.8	Control	-

DL 5% =1.9 DL1%= 3.0 DL 0.1%= 4.8

Table 2.

Attack frequency of fungus Discula destructiva between 2017 and 2019

Factor B- Year	2017	2018	2019	Average
Averages	18.7	21.6	25	21.8
Differences	-3.1	-0.2	3.2	Control
Significance	o	-	*	-

DL 5% = 2.7 DL1%= 3.7 DL 0.1%= 5.0

Analyzing the attack intensity of Cornelian cherry's anthracnose, comparing with attack frequency, the statistical calculations point out that the shrubs from Tunele population was the most affected by the diseases (table 4). This result was point out by the significant difference to control registered by the mentioned population of Cornelian cherry shrubs. The other three populations registered values of anthracnose attack intensity difference reported to control below significance value (table 4).

Table 3.

Attack intensity evolution of fungus Discula destructiva on the evaluated populations

Nr.	Factor A Populations	Factor B - Experimental year			Factor A averages	Differences	Significance
		2017	2018	2019			
1	Bogodinți	9.3	8.0	14.0	10.4	-1.8	-
2	Tunele	10.7	15.7	17.3	14.6	2.4	*
3	Șușara	8.3	11.0	16.0	11.8	-0.4	-
4	Șopot	9.7	11.7	14.7	12.0	-0.2	-
5	Average	9.5	11.6	15.5	12.2	Control	-

DL 5% = 2.4 DL1%= 3.7 DL 0.1%= 5.9

Table 4.

Attack intensity of fungus *Discula destructiva* between 2017 and 2019

Factor B- Year	2017	2018	2019	Average
Averages	9.5	11.6	15.5	12.2
Differences	-2.7	-0.6	3.3	Control
Significance	o	-	**	-

DL 5% = 2.1 DL1%= 2.9 DL 0.1%= 4.0

The only explanation of this situation is the fact that at least one parameter of the climate conditions on the area of Tunele population is different than in the case of the other three populations. And it is the suspicion that the main change in the microclimate of the Tunele population area is different regarding the time of leaves drying by the morning dew during the summer time. This fact is completely in the debt of the narrow canyon where the Tunele populations is placed which maintain a high air humidity.

Evolution of attack intensity during the three years bring interesting results. After statistic analyze it was obvious that the different evolution of temperature and rain amount was decisive for the strength of fungus *Discula destructiva* attack. Taking this in consideration, the 2017 value of attack intensity average reported to control was from statistical point of view significant negative. This result reflects the fact that in 2017 was registered the lowest rain amount comparing to the other two experimental years(table 4).

In 2018 the amount of rain water was higher than in 2017 but it was not high enough to recover the effect of the lack of rain from 2017. This is the reason why the attack intensity was higher than the value from 2017 but in the same time to low to bring any statistically significance reported to control value(table 4). In 2019, the amount of water from rainfall was higher than any previous year. In trend with rains, the average of attack intensity was higher and the difference to control was statically distinctly significant(table 4).

CONCLUSIONS

1. As the results of attack frequency and attack intensity demonstrate during the three experimental years, fungs *Discula destructiva* is highly influenced by the rain amount and the air humidity.
2. The fact that over three years anthracnose was present in all four populations bring the conclusion that the amount of fungus inoculum is at a level which show that this fungus could be endemic.

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